

HACKH'S CHEMICAL DICTIONARY

[*American and British Usage*]

*Containing the Words Generally Used in Chemistry,
and Many of the Terms Used in the Related
Sciences of Physics, Astrophysics, Mineralogy,
Pharmacy, Agriculture, Biology,
Medicine, Engineering, etc.*

Based on Recent Chemical Literature

FOURTH EDITION

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HACKH'S CHEMICAL DICTIONARY

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chemical- Galvanic e. **dynamic-** Current or galvanic as opposed to static e. It indicates electrons in movement. It may be generated by chemical reaction (voltaic), induction (faradic), or magnets (magnetic). **faradic-** Induced e. A current of high voltage produced in a secondary coil when a galvanic current passes through the primary coil of an induction machine. **frictional-** Static e. obtained by friction, e.g., rubbing a glass rod with fur. **galvanic-** Dynamic. **induced-** Faradic. **negative-** A current of electrons passing from anode to cathode outside, and from cathode to anode inside, a galvanic cell. **photo-** See *photoelectricity*. **positive-** (1) An absence or deficiency of negative electrons. (2) A current in the direction opposite to negative. According to this convention, a current flows from negative to positive. **static-** Frictional, as opposed to dynamic. It indicates electrons accumulated at rest, and their sudden escape from the surface of an insulated conductor. **thermo-** (1) E. produced by heat. (2) The heating effects of e. **tribo-** E. produced by friction. **voltaic-** A current produced by an electric battery. **electrification.** Charging with electricity or electrons. **electrify.** To charge with electricity. **electron.** Early name for electron. **electroaffinity.** E or E_0 . Electrolytic potential. The electrode potential, q.v., for a concentration corresponding with 1 gm ion/liter of ions liberated from an electrode. See *electromotive force*. **electroanalysis.** Analytical methods based on electrolysis or conductometry; as, electrometric titration. **electrochemical.** Pertaining to both chemistry and electricity. **e. constant.** Faraday. **e. deposition.** The formation of a metallic layer by electrolysis for: (1) recovery of metals from ores, or refining metals; (2) electroplating, to produce a protective or ornamental coating, or for reproduction, e.g., in photoengraving. **e. equivalent.** E . The mass in grams of any element deposited from an electrolytic cell by an electric current of 1 coulomb: $E = (A/V)0.000,010,36$, where A is the atomic weight, and V the valency of the element. Cf. *Faraday's law*. **e. machining.** Finishing an article by making it an e. anode, the cathode being shaped to impart the required form when material is transferred to it from the anode by electroplating in reverse. **e. series.** Displacement series. **e. spectrum.** A current-voltage graph produced by the polarograph, q.v. **electrochemistry.** The science of transforming chemical into electrical energy, and vice versa. **electrocratic.** Describing a colloid stabilized by an electric charge. **electrode.** The device by which an electric current passes into or out of a cell, apparatus, or body. It may be a simple wire or complex device, (hydrogen e.) or the container of the cell itself. **auxiliary-** A standard e. used during electrodeposition to measure the potential at which this occurs. **calomel-** See (1) *calomel e.*, (2) *Hildebrand e.* **capillary-** See *Lippmann e.* **dropping-** A standard e. formed by a stream of mercury falling in fine droplets through a capillary tube into the electrolyte. A fresh surface is thus obtained continuously. Cf. *polarograph*, *Heyrovsky*. **gas-** See *gas e.* **gas-jet-** See *sprudel effect*. **glass-** A thin glass membrane

separating solutions of known and unknown pH value, the potential difference between the 2 sides being measured. **Hildebrand-** q.v. **hydrogen-** q.v. **negative-** The cathode, negode, or negatively charged pole, by which the current "passes out," and to which anions are attracted. **positive-** The anode, posode, or positively charged pole, by which the current "enters," and to which cations are attracted. **quinone-** q.v. **reversible-** An e. which owes its potential to reversible ionic changes as $H_2 \rightleftharpoons 2H^+ + 2e^-$.

e. potential. The tendency, expressed in volts, of a metal to dissolve in a solution containing its ions. The algebraic difference of the 2e. potentials of the electrodes gives the voltage E of the cell $= E_0 + (0.058/n) \log C$, where C is the concentration in gram ions per liter of the ions given off by the e., E_0 the electroaffinity, n the valency of the ion.

electrodeposition. The precipitation of a metal on an electrode. **e. analysis.** The quantitative e. of an element from a solution. The electrode is weighed before and after deposition.

electrodynamics. The study of moving charges.

electrodynamometer. An instrument to measure the intensity of faradic and alternating currents.

electroencephalogram. An electrical record of the waveform of electric currents developed in the human brain.

electroendosmosis. The production of endosmosis, q.v., by an electric potential.

electroforming. The production of metallic tubes, sheets, or patterns by electrolysis.

electrographic analysis. The qualitative analysis of a metallic surface by placing it in contact with a gelatin-coated paper saturated with an electrolyte and making it the anode of an applied electric current. After removal of the electrolyte, a suitable reagent is added to the paper. Any suitable other metal may be used as electrode on the other side of the paper.

electroless deposition. The deposition of a metal in solution on another solid metal by chemical means, instead of by means of an electric current as in electrodeposition, e.g., by the reducing action of hypophosphites in nickel plating.

electroluminescence. Electrophotoluminescence. The adiabatic emission of light by certain substances when placed in an electric field.

electrolysis. The separation of the ions of an electrolyte hence, the decomposition of a compound, liquid, molten, or in solution, by an electric current. Cf. *electrochemical decomposition*. **internal-** The separation of a metal in the presence of a much more electropositive (i.e., baser) metal, by inserting an anode of the baser metal in the solution, and connecting it directly with a platinum cathode on which the metal is deposited. No external current is required; e.g., Cu on Zn immersed in $CuSO_4$ solution.

electrolyte. (1) A substance that dissociates into 2 or more ions, to some extent, in water. Solutions of e. thus conduct the electric current and can be decomposed by it (*electrolysis*). (2) Sulfuric acid, d.1.150-1.835, used in batteries and accumulators. **non-** A substance that does not dissociate into ions. **strong-** An e. that is highly dissociated even at moderate dilutions, and does not obey Ostwald's

dilution law. **weak-** An e. that is fully or partly dissociated only at high dilution, and obeys the dilution law.

electrolytic. Pertaining to decomposition by an electric current. **e. apparatus.** An ammeter, voltmeter, rheostat, and rotating platinum anode for quantitative electrodeposition. **e. dissociation.** Ionization. **e. gas.** A mixture of hydrogen (2 vol.) and oxygen (1 vol.) obtained by electrolysis of water. **e. potential.** Electroaffinity. **e. separation.** The graded electrodeposition, q.v., of metals from a solution, by varying the applied potential according to the electrode potentials of the metals. **e. solution tension theory.** Nernst theory.

electrolyze, electrolyse. To subject to electrolysis.

electromagnet. Soft iron around which is wound an insulated wire; while an electric current passes through the wire, the iron is magnetized.

electromagnetic. Pertaining to electricity and magnetism. **e. field.** The area of force surrounding an electromagnet or a conductor through which a current flows. The intensity of the magnetic field at the center of a circular conductor of radius r is $2i/r$, where i is the current. **e. law.** See *Coulomb*. **e. radiation.** See *radiation*. **e. separation.** The separation of the magnetic constituents of ores by means of an electromagnet. **e. units.** emu. A system of electrical units based on dynamics; it includes the practical units (volts, ampere, ohm, etc.) which are multiples or fractions of the cgs e. units. See *electrical units* (table).

electromerism. Mobile electron tautomerism shown by a set of compounds, the electron constellations of which vary in position, although the atomic kernels do not. Cf. *chelate bond*.

electromers. Isomers that differ in the distribution of electrons among their atoms.

electrometer. An instrument to measure the quantity or intensity of an electric current. **absolute-** Galvanometer. **Ammeter.** **capillary-** A null-point e. which detects 1 mv by the motion, in a capillary tube, of a dilute sulfuric acid-mercury interface. **emanation-** See *emanation*. **photo-** Photogalvanometer. **quadrant-** Galvanoscope.

electromotion. Mechanical action produced by electricity.

electromotive. In motion produced by electricity. **e. force.** e , emf. Electric pressure, voltage. The work, in volts per unit quantity of electricity flowing through a cell.

1 international volt = 1.00043 absolute volts

1 absolute volt = 0.99957 international volt

= 1 practical emu

= 10^8 cgs emu

= 0.0033349 esu

For molar concentrations the emf of an electrolytic cell is the algebraic difference between the electroaffinities, q.v., of the ions of the metals forming the electrodes. See *electrode potential*. **e. series.** Displacement series.

electron. (1) An alloy: Mg 90, Al 5%, and a little Zn, Mn, or Cu. (2) Negatron, β particle. An elementary unit of electricity, or a negatively

charged corpuscle, whose accumulation on an insulated conductor produces static electricity, and whose flow through a conductor produces an electric current. Electrons are in the atomic nucleus and atomic shell, and their number and arrangement account for valency and other properties. Electrons are liberated from the atom by radioactive disintegration, and transferred from one atom to another in oxidation-reduction reactions (electronation). They are made visible by the Wilson track method, and Millikan's fog chamber. Their mass changes with their velocity. Constants are:

Mass..... 9.035×10^{-28} gm

Charge..... 4.8029×10^{-10} esu
or 1.602×10^{-20} emu

Spin (angular momentum)... 9.02×10^{-28} erg-sec

Cf. *e. atom*. **Auger-** See secondary electron *spectroscopy*. **binding-** An e. which holds together the positive charges in the atomic nucleus. **cementing-** An e. which is assumed to hold together the 2 H nuclei of the helium atom. **free-** (1) A corpuscle or charge of negative electricity (mass 9.01×10^{-28} gm). (2) An e. in an atom which is not shared by another atom. **heavy-** Yukawa particle. A penetrating component of cosmic rays, having an electronic charge greater than that of an e., but less than that of a proton. **metastasic-** An e. which changes its position in the atom owing to radioactive changes; generally moving from the valence orbit into the interior. **negative-** Negatron or free e. Cf. *positive e.* **nuclear-** E. of the atomic nucleus. **orbital-** E. in the orbit of an atom. **paired-** One of 2 electrons constituting a nonpolar bond, q.v. Cf. *twin e.* **phoretic-** E. which conduct by passing freely from atom to atom when their outer orbits are in contact. **photo-** E. liberated from a surface by exposure to light. **piezo-** A supposedly disk-shaped e. in the helium nucleus. **positive-** (1) A heavy small corpuscle associated with a mass more than that of hydrogen; is assumed to be an H nucleus or atom from which an e. has been removed. (2) Positron, q.v. A particle of nearly zero mass with a positive charge. **recoil-** E. scattered by bombardment of a substance with α or β rays. **secondary-** Auger- E. emitted by a metal surface irradiated with X rays of 150-200 kv frequency. They affect photographic film to extents that depend on the atomic number of the surface metal and are used in qualitative analysis. **twin-** See *paired e.* **valency-** The 1 to 8 electrons in the outer orbit of an atom which are responsible for valency. They can pass from one atom to the other (polar bond) or be held in common by 2 atoms (nonpolar bond). See *bond, valency*.

e. affinity. The capture by a substance, e.g., an oxidizing agent, of the electrons of other substances. See *electronate*. **e. beam.** A stream of electrons, as in a cathode tube. **e. compounds rule.** The position of the phase boundaries, at room temperature, in the equilibrium diagram of a binary alloy depends on the e. concentration. **e. diffraction.** The diffraction of a stream of electrons by a surface. Cf. *e. microscope*. **e. displacement.** A shift of an e. pair held in common between 2 atomic nuclei, toward one nucleus. See *Lucas theory*. **e. distribution curve.** A curve showing the e. distribution